this theory the intraocular tension will vary with the relationship of secretion to excretion of lymph. It is clearly a postulate of the theory that some alteration in the volume of the globe occurs under differing internal pressures, though the necessary amount may be so slight as almost to escape the ordinary crude methods of experimental analysis.

Dr. Henderson propounds a theory which is merely the application of the Monro-Kellie doctrine of intracranial pressure to the eye. This theory of intracranial pressure has been proved substantially true by the researches of Mr. Leonard Hill, and Dr. Henderson, postulating the constancy of volume of the eyeball under all pressures, physiological and pathological, embarks upon a bold attempt to make all the arguments fit in the case of the eye. He holds that in the normal eye the total volume is constant, the circulatory system is elastic, and that diffusion takes place between the contained fluids and the return (venous) circulation. Hence the intraocular pressure is equal to the venous pressure of the elastic system. In glaucoma the total volume is fixed, and there is an absence of diffusion between the contained fluids and the return circulation. Hence the fluid and incompressible contents act as a rigid volume, converting the elastic circulatory system into a rigid one. The outflow pressure of a rigid system is always higher than that of a similar elastic system of tubes. Therefore the intraocular pressure is raised, as the lowest circulatory pressure is that of a rigid, not an elastic system. The starting point of the process in glaucoma is held to be sclerosis of the cribriform or pectinate ligament, whereby the diffusion of the aqueous into Schlemm's canal is hindered. The explanation of the success of iridectomy as a cure for the disease is founded upon the fact that wounds of the healthy iris stroma do not cicatrise in the ordinary manner of connective tissues. The aqueous is thus brought into more intimate contact with the iris veins, and is enabled to drain away.

It will be realised from this brief account that the theory is revolutionary in its relation to certain hitherto accepted facts. In some such instances the author has audaciously thrown over the facts. The most striking example of this procedure concerns the anatomy of the ciliary circulation. No one has previously questioned Leber's brilliant researches on the circulation of the eye. Dr. Henderson, from an exhaustive examination of serial sections, asserts that the circulus arteriosus iridis major is not an artery but a vein. Adopting the teleological argument that there is no rhyme or reason for such an abundant arterial supply to so insignificant a structure as the iris, it is an easy step to transform arteries into veins for the benefit of the theory. We do not consider that the examination of serial sections can possibly prove the point conclusively, unless the blood-vessels have been previously injected, as was done in Leber's researches. It may be hoped that Dr. Henderson or others will adopt this more conclusive test.

Dr. Henderson's fundamental postulate, that of the constancy of volume of the eyeball under physiological and pathological pressures, cannot be accepted without reserve. The walls of the eye, though rigid, cannot be regarded as rigid in the same sense as the walls of the cranium. There is experimental evidence to the contrary, notably that afforded by the researches of Koster Gzn. Further, there is positive evidence of vasomotor changes in the intraocular blood-vessels, a fact which militates against the theory.

Moreover, if the intraocular pressure is purely a question of transmitted hydrostatic pressure in the sense of the term as used by Dr. Henderson, why does the pressure fall slowly and gradually when the eyeball is excised? This and other questions will have to be answered satisfactorily before the theory can be adopted. There is no doubt, however, that the author has elaborated an important element of the problem. His work should be read by all physiologists and ophthalmologists, and cannot but prove to be stimulating to thought, and, it may be hoped, to further experimental research.

EXPERIMENTAL THERAPEUTICS.

Einführung in die experimentelle Therapie. By Prof. M. Jacoby. Pp. vii+180. (Berlin: J. Springer, 1910.) Price 5 marks.

UNTIL the middle of last century therapeutics was a purely clinical study, the physician treating his patients on purely empirical grounds and without any clearly conceived idea of how his measures affected the course of the disease. About fifty years ago the experimental study of the action of drugs was taken up by a number of investigators, and the school of experimental pharmacology succeeded to the ancient study of materia medica. The benefits accruing to medicine from this school are recognised by all who have followed the course of therapeutics in the last half-century; but its members in some degree have stood aloof from the great movement which, beginning with the discovery of pathogenic organisms, has progressed to the discovery of their antidotes in the antitoxins, and to the treatment of disease by these last. The workers on therapeutics who have approached the subject from the bacteriological laboratory have accordingly assumed a new and distinct title for it—experimental therapeutics—and show a tendency to broaden its borders to include such work as that which has culminated in Ehrlich's discovery of the new anti-syphilitic specific. Yet the methods followed by Ehrlich are exactly similar in essentials to those of Schmiedeberg or von Mering in their researches on hypnotics; and the fact that the former was seeking a remedy to act on the treponema in the tissues, and the others for a remedy for the over-excited nerve cell, does not seem to justify their subjects being classed under different headings.

The book before us seeks to give a bird's-eye view of the position of the subjects in therapeutics which have recently been investigated experimentally. Beginning with some examples of pharmacological antagonism, the author leads us through the development of the therapeutics of the internal secretions (*Substitutionstherapie*) to the experimental investigations on antiparisiticides; under this he groups the treatment with vaccines, antitoxins, and Ehrlich's

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new arsenic compounds. Short chapters are devoted to the therapeutics of tumours, inflammation, blood-diseases, gout, fever, and disturbances of the circulation and digestion so far as these have been determined by experimental methods. It is, of course, impossible to treat this extensive programme exhaustively in 174 pages, and the author seems rather to have aimed at giving a general idea of what is being done to advance therapeutics experimentally with the object of arousing the interest of the students and younger practitioners of medicine in the subject. The book seems well fitted to attain this object, for it is written in an easy style, and deals with some of the most interesting topics in medicine at the present time. On the other hand, the chapters are very unequally written. In some instances pages are devoted to detailed description of surgical methods (pp. 34–36) or of individual experiments, which seem out of place in an introductory handbook, while other subjects are treated too briefly for anyone to follow except the expert; and there is very little attempt made to differentiate the fundamental experiment from the less important or less generally accepted result.

The author tends too often to leave the solid ground for speculations which are often based on experiments which, to say the least, have not yet received general assent. In a book primarily designed for German medical students, perhaps it is right to direct their attention chiefly to authors of their own nationality whose works they can read, but we cannot help thinking that some of the chapters would have been improved by wider reading. For example, the chapter on vaccines might have been rendered more intelligible and also more up-to-date.

The book is not free from serious errors; for example, where (p. 11) it is stated that Hunt found alcohol protects mice against the nitriles; and the antidotal effect of sodium sulphate in barium poisoning is surely due to the barium being precipitated, and not to the restoration of the sodium, as the author supposes (p. 13).

PROJECTIVE GEOMETRY.

Projective Geometry. By Prof. O. Veblen and Prof. J. W. Young. Vol. i. Pp. x+342. (Boston and London: Ginn and Co., 1910.) Price 15*s.* net.

IN the first page of their introduction the authors say:

"The starting-point of any strictly logical treatment of geometry must be a set of undefined elements and relations, and a set of unproved propositions involving them; and from these all other propositions (theorems) are to be derived by the methods of formal logic."

Here, in a nutshell, is the modern mathematician's creed; and it is significant that it should thus appear in a treatise on projective geometry, which at first sight would seem to be one of the most intuitive of the branches of mathematics.

In accordance with the above dictum, the authors give a brief discussion of the axioms of geometry so far as they are required for the purposes of this volume, rightly, we think, deferring the more complete theory of order and continuity to a later stage. Enough, however, is done to make the reader aware of the numerous tacit, and often complex, assumptions made in the ordinary treatment of the subject. For instance, we have an explicit statement of the fundamental postulate:

"If A, B, C are points not all in a line, and D, E are distinct points such that (B, C, D), (C, E, A) are respectively collinear, then there is a point F such that (A, B, F) and (D, E, F) are respectively collinear."

With the help of this and a few other assumptions, a plane is defined in such a way that it can be *proved* that if A, B are any two points in a plane, every point of the line AB is in the plane. No one can fail to see that this is an improvement on the Euclidean definition of a plane, which is a question-begging assumption, based no doubt on the practical tests applied by masons and carpenters.

After this the reader is introduced to the fundamental operations of projection and section, and to the principle of duality. The latter is very properly stated, at the outset, with reference to three-dimensional space: that is, point and plane are correlative terms, not point and line. It is easy enough to deduce the special laws of duality for two-dimensional fields; and the more general form of statement at once brings home to the student the fact that, as a rule, the propositions of projective geometry arrange themselves in sets of four, only one of which need be formally proved. For instance, Pascal's theorem for a conic in a plane leads at once to Brianchon's theorem, and two corresponding theorems for a quadric cone.

Even yet it may be asserted that von Staudt is the great master of projective geometry, much as Gauss is the incomparable arithmetician. It is one of the great merits of this work that the influence of von Staudt's work is so apparent in it. For instance, involution is treated at a comparatively early stage; and this is important for several reasons. In the first place, it simplifies the proofs of many fundamental properties of conics; in the second, it shows the existence of a polar system, in a plane or in space, apart from the assumption of a quadric curve or surface defining it. Ultimately, of course, the best definition of a conic or quadric surface is that it is the locus of self-corresponding points in a polar system. This, with Staudt's theory of imaginary (or complex) elements, permits of the inclusion of "imaginary" conics and quadrics as actually existing things. It is to be hoped that the second volume will contain a sufficient account of Staudt's beautiful theory, which, as a rule, seems to be very imperfectly apprehended. As he unfolds it in the supplements to his "Geometrie der Lage," it is purely geometrical, though no doubt he was led to it by analysis—at least, this seems the most probable assumption.

Among the interesting points of the present volume there is a brief account of Staudt's theory of "throws" (*Würfe*), and his constructions for addition and multiplication. In the latter there is a slight modification, arising from a change in the order of deduction. What is here shown is that if we take any three points

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